ISSN No: - 2456- 2165

Anamolous Behaviour Detection Using Lucas Kanade and Harris Corner Detector

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***Abstract*— Image processing has played a vital role in every aspect of human life. Video surveillance has reached a major out through by the application of advanced image processing and frame modeling techniques. Video surveillance is the most recent issue regarding community security and welfare. A monitoring system imparts the usefulness of imaging technology to detect, recognize and track a person or item of the suspect. Detection of behavior of moving objects in video streams is the a vital aspect. In this thesis, automatic real-time object detection and its behavior detection is implemented using Lucas Kanade and Harris Corner based approach. The velocity of various moving elements is reported in this article and its association with anomalous activity is also an inseparable part of this art. This work could be used to develop a surveillance system of static camera and robotic automation visual systems. Whenever a new object comes in the camera frame, a system uses the concepts of frame based processing using Lucas Kanade approach incorporated with Harris Corner Detector. The work presented here has been extended to work at video processing stage. In the later section, an investigation is carried out to define the optimum value of velocity parameters to define a behavior as anomalous. And it is analyzed that even though such an algorithm for video behaviour detection at traffic points perform well but its accuracy can be further enhanced using three dimensional imaging and mapping of moving elements in a hyperspace.**

Keywords—harris corner, spatio-temporal information, lucas kanade approach, anamolity detection

I. INTRODUCTION

The continuous protest discovery and following has been an incredible field of research since the rise of the field of Computer Vision and Image handling. Prior many incredible commitments had been finished by different researchers in this been field. The video observation frameworks can be arranged under two general classifications

a. Static camera frameworks

b. Moving camera frameworks

Their reference outline portrays static camera frameworks that remaining parts consistent all through the procedure. The work introduced here is significantly focused on static frameworks, while the displayed idea can be stretched out to moving camera frameworks by convenient fluctuating their reference outlines. Foundation Subtraction method has utilized a considerable measure as a part of past works. In any case, as innovation builds up the preparing time of new calculations keeps on contracting, here is excessively proposed another technique that is quick in handling with fine outcomes. Protest recognition should be possible by two techniques:

a. Automatic frameworks

b. Manual frameworks

The standard framework requests of some human obstruction to finding any regular figure on the remote object [1],[2], while in robotized frameworks once the parameters have got set it can recognize new outside protest without anyone else. In present day frameworks, this system can be executed too by utilizing shading or surface data [3] of remote protests in the edge. In past approach, there has been a utilization of reference organizes in the framework to recognize new questions; these directions can be gotten by taking edges of settled bodies in the reference outlines that confine to perform inside a specific class of reconnaissance frameworks. In headway to that, this method deals with single or multi protest identifications by utilizing morphological operations as a part of the field of flag preparing. A ton of commitment had been finished by different researchers since a rise of the field of Robotic Automation Vision Systems.

A hefty portion of them worked utilizing the standards of joining forefront location with the question following. A substantial number of calculations have been propounded in this field incorporates different picture division, for example, N-cut strategy, Otsu-based picture division, Background Subtraction Method took after by following [4].

The business related in this exposition and the exploration objectives which identity with the cutting edge pertinence of this theory, to the degree of the importance of video observation for following atypical movement conduct caught in an advanced camcorder[5].

In this proposal, for the exploratory purpose, it is reproduced for various foundation subtraction strategies to beat the trouble of brightening variety, foundation litter, and shadows. Recognizing and following of human body parts is the primary in human comprehension developments[7]. Sensible and robotized assurance reconnaissance strategies have become an active review zone in up and coming the time as a result of a developing interest in such projects out in the open spots like air terminals, underground stations, and mass schedule. In this unique circumstance, following of stationary closer view zones is a standout amongst the most focal benchmarks for reconnaissance frameworks focused on the following of abandoned or stolen questions or stopped automobiles. The question following focused systems is the trendiest other option to watch stationary frontal area protests

ISSN No: - 2456- 2165

on record that they work decently well when the camera is stationary, and the change in surrounding lighting installations is continuous, they also speak to likely the most favored alternative to separate forefront objects from the present casing of study.

The area of computerized surveillance packages is at this time of big curiosity accordingly of its implications within the field of protection. Monitoring of vehicular visitors and human actions offers a context for the extraction of giant competencies much like scene motion and viewers know-how, object classification, human identification, anomaly detection, as right because of the analysis of interactions between vehicles, between people or between cars and men and women. A large sort of study possibilities is open regarding video surveillance and monitoring.

Applications of picture segmentation include identification of objects, feature extraction, and many others. [9],[10]. Segmentation of simple grey-degree graphics additionally provides valuable expertise concerning the surfaces within the scene [4].

II. LITERATURE SURVEY

Object monitoring is a very difficult enterprise in the presence of variability in Illumination concern, heritage motion, elaborate object form, partial and entire object occlusions. Correct here in this thesis; the exchange is done to beat the situation of illumination version and historical past litter comparable to the fake action as a result of the leaves of the timber, water flowing, or flag waving in the wind. Object monitoring includes tracking of a single rationale, and that is carried out using normalized correlation coefficient and updating the template[2].

The surveillance procedure is the process for monitoring the behavior, events or different changing potential, most in most cases men and women for the purpose of influencing, managing, directing, and defending. Lots of the surveillance procedure includes a static digicam and constant background which presents a clue for the item detection in videos using historical past subtraction manner. In monitoring method three predominant primary steps, these are object detection, object monitoring, and consciousness.

Some challenges in video processing Video evaluation, video segmentation, video compression, video indexing. In the case of video evaluation, there are three key steps: detection of an intriguing relocating object, monitoring of such objects from the body to border and evaluation of objects tracks to admire their behavior. Subsequent it comes video segmentation, it approaches separation of objects from the historical past. It additionally includes three first steps: object detection, object monitoring and object awareness. In this work, it has given more center of attention in the direction of the video investigation of evaluation and video segmentation part.

It began with the aid of [1]Brice and Fenema (1970), Pavlidis (1972), Rosenfeld and Kak (1976). Brice and Fenema labored on restrained optimization obstacle of controlling the smoothness of boundaries in an picture representing each and every object greatly.

In 1979 Otsu[2] proposed a histogram headquartered process to maximise the category variance amongst extraordinary courses, each representing a single object.

Later Mumford Shah (1985, 1989)[3] worked on localized photograph segmentation main issue and concluded to area developing headquartered image segmentation method , which is the most standard one but. Threshold choice in picture segmentation is a difficult project. It presents principal knowledge about photo and play primary role in segmentation of photo. Several different methods for deciding on a threshold exist; customers can manually pick a threshold worth, or a thresholding algorithm can compute a value robotically, which is referred to as automatic threshold [4]. One among such simpler ways used is to decide on both the mean or median value, depending on the whether or not the item pixels are brighter than the history [5].

A extra proximate solution is to make use of the histogram of the picture pixel intensities and take advantage of the valley point as the threshold price [6]. This case might not be normally as the picture noise may just fade the valley point, for this kind of case we should check with Otsu's snapshot thresholding process [7].

For the sake of relocating object monitoring motive, Kalman Filter and its modified models are nonetheless in use in lots of prestigious global authorities equivalent to NASA, ISRO and many others for his or her rockets navigation[8]. Kalman Filter was in the beginning integrated in Apollo navigation desktops.

Kalman Filter and its underlying thought was once proposed with the aid of, "Rudolph E. Kalman," [8]. Kalman filter operates on input data to participate in a statistically gold standard answer of the used method, its output will get filtered of any noisy component rendered either as a result of input noise or output noise. In at present's era this process is used in multitude of navigation methods similar to missile and so on. It is being employed in the methods of VR (virtual fact) and AR (Augmented fact) [9] to monitor the human motions in a digital space.

The foremost quandary related to the Kalman Filter was that it used to be relevant just for linear programs, so some modification wanted to be performed in its structuring expressions to make it usable in the sensible Non-linear units. In NASA Ames [10] , the elevated Kalman filter used to be developed, which incorporate multivariate Taylor sequence expansion, to make it linearise about a working point.

A traditional automatic single digital camera surveillance technique in most cases involves three foremost factors, which will also be listed as moving object detection, object tracking and event awareness. For the confronted barriers, it is to alleviation an automated relocating intention detection and monitoring valuable elements. The procedure of automatic monitoring of objects begins off advanced with the identification of relocating objects. An improved background subtraction procedure together with a novel, however, easy background mannequin to obtain quality segmentation is used. Once the relocating pixels are well-known, it is central to cluster these pixels into regions, which is referred as blobs, so that pixels belonging to a single object are grouped collectively. Handiest moving objects are incorrectly separated into two or further sub-areas in view that of lack of

ISSN No: - 2456- 2165

connectivity between pixels, which ordinarily occurs due to the fact of occlusion from other objects.

III. Optical Flow

Optical flow or optic stream is the example of clear movement of items, surfaces, and edges in a visual scene brought about by the relative movement between an eyewitness and a scene.[1][2] The idea of an optical stream was presented by the American analyst James J. Gibson in the 1940s to portray the visual boost gave to creatures traveling through the world.[3] Gibson focused on the significance of optic stream for affordance observation, the capacity to recognize likely outcomes for activity inside the earth. Adherents of Gibson and his natural way to deal with brain science have additionally shown the part of the optical stream jolt for the impression of development by the onlooker on the planet; view of the shape, separation and development of articles on the globe; and the control of locomotion[4]. Picture examination methods are utilized to distinguish ordinary and strange occasions and diverse sorts of visual articles (individual, bundle, auto, and so forth.) and concentrate their qualities (speed, bearing, vanishing/appearance, position).

To be sure, occasion identification in a video is turning into an essential application for PC vision, primarily with regards to movement acknowledgment [3]. To accomplish this objective, many methodologies utilize neighborhood descriptors on wanted focuses in pictures [4] and video [5]. These systems depend on communicating the nearby locale around a range of intrigue. Notwithstanding, these procedures depend on the suspicion that we can dependably identify enough stable intrigue focuses on the picture or the video (picture arrangements). This implies for space-time intrigue focuses the video succession ought to have a few examples of basic movement occasions (areas) where the particular protest alters its course of movement (e.g. the high contrast striped circle that turn ceaselessly with wanted speed. One of the techniques that can be utilized to find stable intrigue focuses is the estimation of an optical stream. The optical stream is the example of clear 2D movement of articles in groupings of time-ordered pictures. In each video outline, each pixel is connected with a two-dimensional vector, and this vector tells the obvious movement of that pixel, when it moves starting with one casing then onto the next [2].

The optical waft of a photo sequence is defined as a vector discipline, about each picture to the following image (each and everybody to the next body). Each vector suggests the obvious displacement of each and every pixel from photo to picture. Assuming that each and every pixel conserves its intensity, we attain the" Brightness fidelity Constraint" equation.

$$F(x, y, t) = F(x + dx , y + dy, t + dt)$$

IV. Lucas Kanade.

In PC vision, the Lucas–Kanade technique is a utilized differential strategy for optical stream estimation created by Bruce D. Lucas and Takeo Kanade. It accepts that the stream is consistent in a nearby neighborhood of the pixel under thought, and understands the fundamental optical stream conditions for every one of the pixels in that area, by the minimum squares criterion.[1][2]

By consolidating data from a few adjacent pixels, the Lucas–Kanade technique can frequently resolve the intrinsic uncertainty of the optical stream condition. It is additionally less touchy to picture commotion than point-wise strategies. Then again, since it is an absolute neighborhood strategy, it cannot give stream data on the inside of uniform districts of the picture.

The Lucas–Kanade strategy accepts that the relocation of the picture substance between two adjacent moments (edges) is little and around steady inside an area of the point p under thought. In this manner, the optical stream condition can be accepted to hold for all pixels inside a window focused at p. To be specific, the neighborhood picture stream (speed) vector (V_x, V_y) must fulfill.

$$(I_x(q_1)V_x + I_y(q_1)V_y = -I_t(q_1)$$
$$(I_x(q_2)V_x + I_y(q_2)V_y = -I_t(q_2)$$
$$(I_x(q_3)V_x + I_y(q_3)V_y = -I_t(q3)$$
$$\cdot\cdot$$
$$\cdot\cdot$$
$$(I_x(q_n)V_x + I_y(q_n)V_y = -I_t(q_n)$$

$I_x, I_x \text{ and } I_x$ defines the differentiation element pixel qi of input image I with respesct to location element *x,y* and time element *t.*

As a matrix based formulation, it can be rewritten as,

$$A = \begin{bmatrix} I_x(q_1) & I_y(q_1) \\ I_x(q_2) & I_y(q_2) \\ \vdots & \vdots \\ I_x(q_n) & I_y(q_n) \end{bmatrix}$$

$$v = \begin{bmatrix} V_x \\ V_y \end{bmatrix} \qquad b = \begin{bmatrix} -I_t(q_1) \\ -I_t(q_2) \\ \vdots \\ -I_t(q_n) \end{bmatrix}$$

The solution of this equation for evaluation of (V_x, V_y) is given as,

$$\begin{bmatrix} V_x \\ V_y \end{bmatrix} = \begin{bmatrix} \sum_i I_x(q_i)^2 & \sum_i I_x(q_i)I_y(q_i) \\ \sum_i I_y(q_i)I_x(q_i) & \sum_i I_y(q_i)^2 \end{bmatrix}^{-1} \begin{bmatrix} -\sum_i I_x(q_i)I_t(q_i) \\ -\sum_i I_y(q_i)I_t(q_i) \end{bmatrix}$$

V. Harris Corner Detection

Let us assume a shift ($\Delta x, \Delta y$) about a point (*x,y*), then auto-correlation function could be expressed as,

ISSN No: - 2456- 2165

$$c(x, y) = \sum_{W} [I(x_i, y_i) - I(x_i + \Delta x, y_i + \Delta y)]^2$$

Where I(· , ·) denoted the image function and x_i, y_i were the points in the Gaussian window W centered on (x, y).

Via help of Taylor expansion shifted image could be approximated to first order term as,

$$I(x_i + \Delta x, y_i + \Delta y) \approx I(x_i, y_i) + [I_x(x_i, y_i) I_y(x_i, y_i)] \begin{bmatrix} \Delta x \\ \Delta y \end{bmatrix}$$

$I_x(\cdot, \cdot)$ and $I_y(\cdot, \cdot)$ represent the single dimension gradients in x and y directions respectively.

$$c(x, y) = \sum_{W} (I(x_i, y_i) - I(x_i, y_i) - [I_x(x_i, y_i) I_y(x_i, y_i)] \begin{bmatrix} \Delta x \\ \Delta y \end{bmatrix}$$

$$c(x, y) = \sum_{W} (- [I_x(x_i, y_i) I_y(x_i, y_i)] \begin{bmatrix} \Delta x \\ \Delta y \end{bmatrix})^2$$

$$c(x, y) = \begin{bmatrix} \Delta x \\ \Delta y \end{bmatrix}^T \begin{pmatrix} \sum_W (I_x(x_i, y_i))^2 & \sum_W I_x(x_i, y_i) I_y(x_i, y_i) \\ \sum_W I_x(x_i, y_i) I_y(x_i, y_i) & \sum_W (I_y(x_i, y_i))^2 \end{pmatrix} \begin{bmatrix} \Delta x \\ \Delta y \end{bmatrix}$$

$$c(x, y) = \begin{bmatrix} \Delta x \\ \Delta y \end{bmatrix}^T S(x, y) \begin{bmatrix} \Delta x \\ \Delta y \end{bmatrix}$$

$S(x, y)$ Represents the spatial intensity component in localized neighborhood of point (x, y).

VI. Experiemntal Results And Discussion

In this chapter, the experimental results are discussed along with elaborating the simulation environment to perform the experimentation. The experimentation is carried out on Intel Core-I3 Processor operating at 1.83GHz running on a Windows-7 operating platform. The experimentation work is supported by Image Processing Toolbox of MatlabR2013a. The proposed algorithm is investigated over a test video scene "RLT.mp4" (from Youtube) depicting a traffic signal where all cars are passing by at the juncture. Figure.1 depicts the sequences of frame considered for investigation.

Fig.1: Frames extracted from a video sequence

Figure 2 and 3 represent the detected corners and its associated flow vectors.

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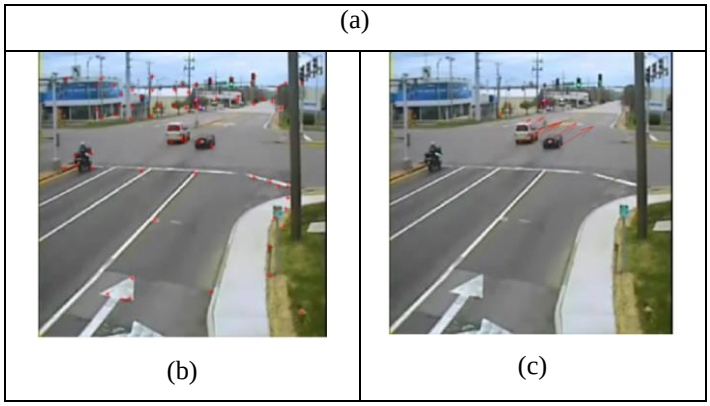

Fig.2.: (a) Original frame and it detected corners in (b) and associated flow vectors in (c).

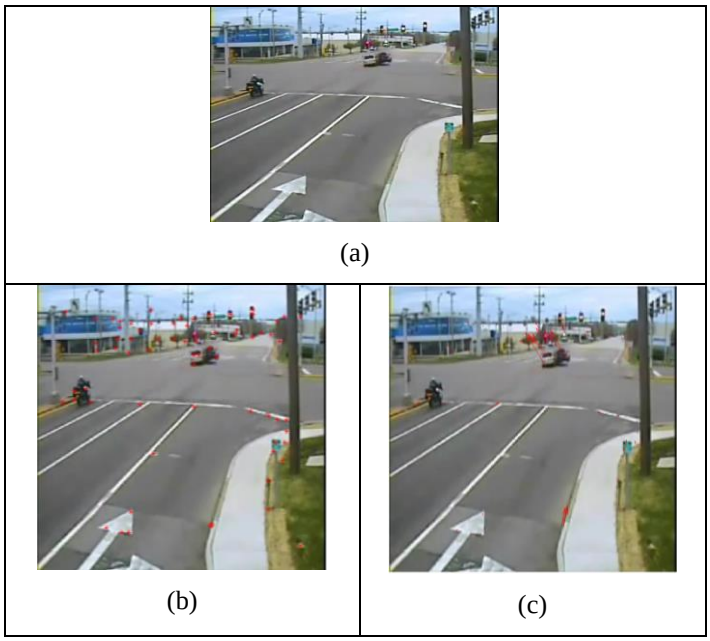

Fig.3.: (a) Original frame and it detected corners in (b) and associated flow vectors in (c).

The red points represents the deteced corners and red vectors are point toward the direction of flow of associated flow vectors. These optical flowe vectors are converted into its magnitude and analyzed for a set of video sequences. The graphical representation of flow vector magnitudes for a set of frame sequences is depicted by fig.4.

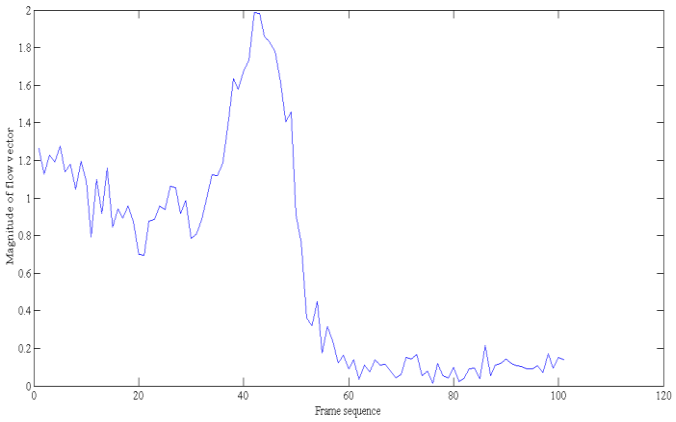

Fig.4: The graphical plot of flow magnitudes.

As obvious from fig.4 that plot attains a maximum value it means that something anamoulus has happened in the sequence within the associated frame.

VII. CONCLUSIONS

Video surveillance has reached a major out through by the application of advanced image processing and frame modeling techniques. Video surveillance is the most recent issue regarding community security and welfare. In this article we have investigated a model for detection of anamolity in a video sequence. It incorporates Lucas Kanade vectors analysis of some feature point (Corners). The magnitude of such flow vectors are analyzed here in this work and it comes to a conclusion that associated research and proposed model gives a significant outcome.

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